

## Response

### **Support for claim 25 as amended and new claim 32**

Claim 25 has been amended by incorporating the limitation of canceled claim 26 (line 14), to point out that the mold forms a closed cavity when it is applied to a joint in the frame for which a lug is to be made (lines 3-5), and to point out that the lay-up and the expandable element whose expansion compacts the lay-up against the tubes are both completely contained within the closed cavity (lines 12 and 13). That the cavity is closed is apparent from FIG. 6, which shows that the halves of the mold abutting each other when applied to the bicycle frame, that the lay-up is contained within the cavity is shown from the wrapping details of FIGs. 9 and 10, and that the expandable element is contained within the cavity is shown from the detail view of mold 603 in FIG. 6 and the detailed view of the lay-up at 705. The process of making a lug using the mold, lay-up, and expandable element is disclosed at [0031]-[0046]. New claim 32 merely removes an element of claim 25 prior to the current amendment to a dependent claim.

### **The problem addressed by Applicant's technique for making lugs**

Applicant is a manufacturer of bicycle frames that are made of carbon fiber tubes. The frame's joints are strengthened by lugs made up of carbon fiber and a matrix material. The problem solved by Applicant's invention is how to compact the lay-up against the tubes of the frame so that voids in the lugs are prevented.

In the bicycle making art, there are two general solutions to the problem: one is to avoid the problem completely by using a large mold to make the entire bicycle frame out of lay-up. Such a frame is termed a monocoque frame. The frame typically has two halves; lay-up is placed in each of the halves, expandable material is placed on top of the lay-up in one of the halves, the mold is closed, and the expandable material is made to expand and force the lay-up against the sides of both halves of the mold. The process is explained at col. 1, line 58-col. 2, line 7 of Hwang. Such a process is of course not usable to compact the lugs of a frame made of carbon tubes: the expandable material would be inside the

tubes and could not expand to compact the lugs; further, if it could compact the lugs, it would compact them against the walls of the mold, rather than against the tubes.

The other solution, exemplified by Bishop and Calfee, is to use molds around the joints to compact the lugs. The lay-up for the lugs is applied to the joints and a two-part mold is applied to the lay-up and tightened to compact the lay-up. To ensure that the lay-up is in fact compacted, more matrix is applied to the joints than needed to make the lug; as the mold is tightened, the excess matrix is squeezed out between the halves of the mold. In both Bishop and Calfee, there is also lay-up including carbon fibers between the halves of the mold; the excess becomes part of that lay-up. See FIG. 4 of Bishop and FIG. 3 of Calfee. In both Bishop and Calfee, some of the lay-up that is between the mold halves becomes gussets. Excess lay-up must be removed as flash. See Fig. 6 of Bishop.

In Applicant's technique, there is no lay-up between the halves of the mold and the mold is closed completely on the lay-up for the lugs, i.e., when the mold is closed, the faces of the halves meet. This avoids the flash problem, but presents a new problem: the fact that the halves meet when the mold is closed permits little or no compression of the lay-up by the mold. To deal with this problem, Applicant includes an expandable element with the lay-up and closes the mold around the expandable element and the lay-up. The mold is then heated; the heat both causes the expandable element to expand and cures the lay-up. As the expandable element expands, it compacts the lay-up against the tubes. Further, since the mold is closed, no substantial amount of flash is produced, or needs to be removed. Two kinds of expandable elements are disclosed in the application: a silicone coating on the inside surfaces of the mold and expandable syntactic foam which is included as part of the lay-up.

#### **Patentability of Applicants' claims over the references**

Applicants' claim 25 as currently amended reads as follows:

**25.** (currently amended) A method of making a lug for a joint that joins carbon fiber tubes in a bicycle frame,

the method employing a ~~closable~~ mold that ~~may be closed around the tubes~~ has surfaces which fit with each other and with the tubes when the mold is closed around the tubes to form a closed cavity that contains the tubes at the joint and the method comprising the steps of:

making a lay-up for the lug of at least carbon fibers and a matrix material around the tubes at the joint, ~~the lay-up forming a continuous wrap around the tubes and being enclosed by the closed mold;~~

~~including an expandable element that is also enclosed by the closed mold;~~

closing the mold around the lay-up, the tubes at the joint, and the an expandable element, the lay-up and the expandable element being completely contained within the closed cavity; and

applying heat from a source outside the cavity to the closed mold to curing ~~cure~~ the lay-up ~~while the mold is closed, the cure of the lay-up~~ heat causing expansion of the expandable element and the expansion compacting the ~~enclosed~~ lay-up against the tubes such that voids in the lug are prevented.

The reference over which this claim must distinguish is Bishop. The fundamental distinctions between Bishop and claim 25 are the following:

- Applicant's method "employ[s] a mold that has surfaces which fit with each other and with the tubes when the mold is closed around the tubes to form a closed cavity that contains the tubes at the joint; and
- Applicant's "lay-up and the expandable element [are] completely contained within the closed cavity"

As will be immediately apparent from Bishop's FIGs. 4 and 6 and the description at col. 4, line 64-col. 5, line 22, when Bishop's mold is closed, the halves of the mold are separated by layers of lay-up. Bishop's mold thus does not have "surfaces which fit with each other and with the tubes when the mold is closed around the tubes to form a closed cavity that contains the tubes at the joint" and Bishop's lay-up is not "completely contained within the closed cavity". The same is the case with regard to Calfee, as shown in FIG. 3 and described at col. 4, line 46-col. 5, line 28. The combined references consequently do not show all of the limitations of amended claim 1, the claim is patentable over the references, and the amendment has overcome the rejection under 35 U.S.C. 103. Further, because claim 25 is patentable over the references, so are all of the dependent claims.

**Independent patentability of certain of the dependent claims***Claims 20, 23, 30, and 32*

These claims have been objected to as being dependent from unpatentable claims; the amendment to claim 25 has overcome this objection.

*Claim 28*

This claim adds the limitation that “the expandable element is a silicone lining on the cavity’s surface”. In his rejection, Examiner refers Applicant to Baron, U.S. Patent 4,954,209. What Baron discloses is a technique which is particularly adapted manufacturing “large, closed sectional circular shaped molded articles which range in diameters of up to 15 to 20 feet” (Baron, col. 2, lines 65-68). As shown in FIG. 7, Barron uses layers of silicon rubber with printed circuit heaters on either side of the lay-up for the molded article to compress and heat the lay-up.” A lug for a bicycle frame is of course a long ways from a molded article with a diameter of up to 15 and 20 feet, and it is difficult to see how Barron’s silicon rubber blankets could be employed in the tight dimensions of Applicants’ molds to compact the lay-up for the lugs against the tubes of the frame.

**Conclusion**

Applicant has amended his claims to better distinguish them from the references, had demonstrated that the claims as amended are fully supported by the Specification as filed, and has demonstrated that the claims as amended are patentable over the references. Applicant has thus been fully responsive to Examiner’s Office action of 7/15/2008 as required by 37 C.F.R. 111(b) and respectfully requests that Examiner continue with his examination and allow the claims as amended, as provided by 37 C.F.R. 1.111(a). A payment of \$555.00 for a three-month extension of time accompanies this response. Please charge any additional fees required for the amendment or refund any overpayments to deposit account number 501315.

Respectfully submitted,

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